

Notes and Comments

Mandibular Ramus Flexure Is a Good Indicator of Sexual Dimorphism

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Kalevi Koski (1996) recently commented on our introduction of posterior ramus flexure of the mandible as an indicator of sexual dimorphism (Loth and Henneberg, 1996). Unfortunately, we see no connection between his comments and our work. Koski observed variables different from ours and used inappropriate methods and samples.

We would like to address the following points:

1. Koski states (1996) "Loth and Henneberg seem to draw a very fine line between the flexure they regard as significant and other possible flexures." Indeed, we do so because the only consistent indicator of sex is the distinct flexure at the occlusal plane in adult males or lack thereof in females. We have established this after careful study of other points of flexure in the ramus which may be present in both sexes. Koski's observations were made by measuring an angle between the condyle and the top of the ramus (using lateral radiographs), while what we found to be consistently dimorphic is the shape of the section of the ramus itself located at the level of the occlusal plane. This point is usually well below the neck of the condyle, and our article clearly states that in females there is sometimes a flexure high at the neck of the condyle well above the occlusal plane. We further indicate that there can also be an angulation around

gonial development, well below the occlusal level. However, only the shape of the occlusally positioned ramal border has a bearing on sex diagnosis. Posterior ramus flexure, as described in our 1996 paper, does not refer to 1) the gradual angulation of the ramus as it ascends to the condyle, or 2) the angle at which the condyle attaches to or protrudes posteriorly from the ramus. Koski also errs by equating a straight ramus with it being vertical or perpendicular to the mandibular body. This is obviously incorrect since nearly all human mandibles angle back from the gonial region to the condyle and many adult mandibles arch posteriorly. Koski's quantification of the angulation between the condyle itself and the ramus is completely irrelevant to our definition of ramus flexure as observed in adult males at the occlusal plane. We regret that Koski had difficulty understanding what Figures 2 and 4 in our 1996 article demonstrate. Figure 2 has a white line clearly delineating the male flexure at the occlusal plane and Figure 4 has an arrow pointing to the female variant of high flex at the neck of the condyle, well above the straight segment at the occlusal plane. This information is also spelled out in the captions.

2. Our research, based on a large ($n = 610$) sample of both sexes from several African, American and European populations, focused on the form of the adult mandible using three-dimensional observations of actual dry-bone specimens. In contrast Koski's observations were limited to lateral radiographs of 40 prepubertal girls (6–8 years old) and 40 "young ladies" (22–28 years of age) from a single population without including any males

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whose mandibles could provide a contrast to the observations on females. In our paper we report that our study of juvenile mandibles of both sexes showed that there is no sexual dimorphism in the shape of the posterior border of the ramus at the level of the occlusal plane (Loth and Henneberg, 1996:482). All juvenile mandibles are perfectly straight from just below the condylar neck to just above the gonial region irrespective of their angle with the body of the mandible, and independent of the obvious transition from the ramus to the condyle.

3. Population differences were addressed in the expression of the flexure. We found that they do not affect the overall accuracy of sexing which ranged from 91% to 99% and averaged 94.2% for 547 adult mandibles (see Table 7 in Loth and Henneberg, 1996).
4. Koski asks for independent confirmation. Obviously this must come from other authors. In the meantime, however, numerous colleagues from around the world

have informed us that they are using our method and find it very helpful and easy to apply. We look forward to publication of their results.

Koski's comments might have some value if he had first examined a series of dry mandibles of all ages and both sexes and assessed our method as we presented it. What we find most distressing is that he cast doubts on ramus flexure after looking at x-rays of a completely different part of the bone in a unisex sample. In conclusion we would like to stress that although the posterior border of the mandibular ramus can be flexed in other places, the only flexure that counts for adult sex diagnosis is that which is located at the level of the occlusal plane.

LITERATURE CITED

- Koski K (1996) Notes and Comments: Mandibular ramus flexure—indicator of sexual dimorphism? *Am. J. Phys. Anthropol.* 101:545–546.
- Loth SR, and Henneberg M (1996) Mandibular ramus flexure: A new morphologic indicator of sexual dimorphism in the human skeleton. *Am. J. Phys. Anthropol.* 99:473–485.